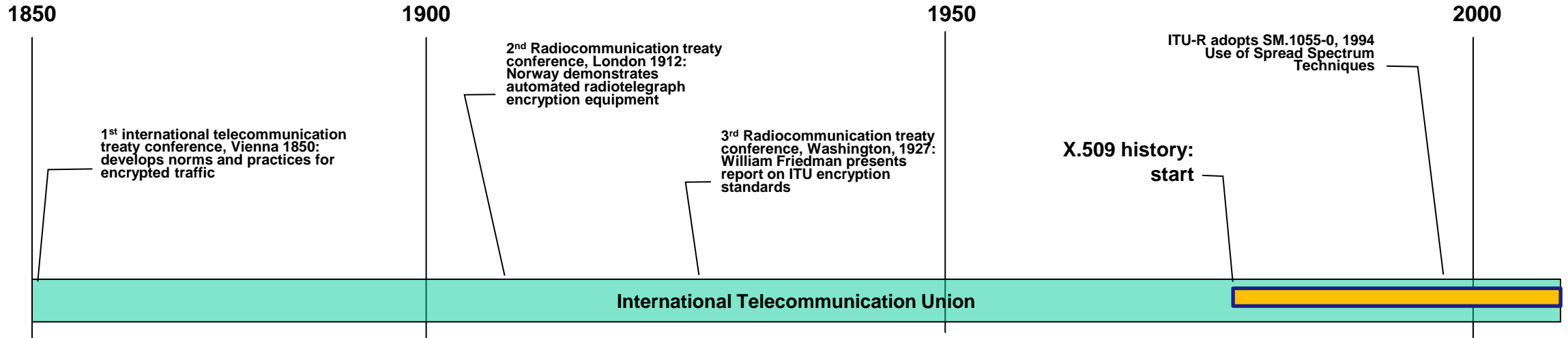
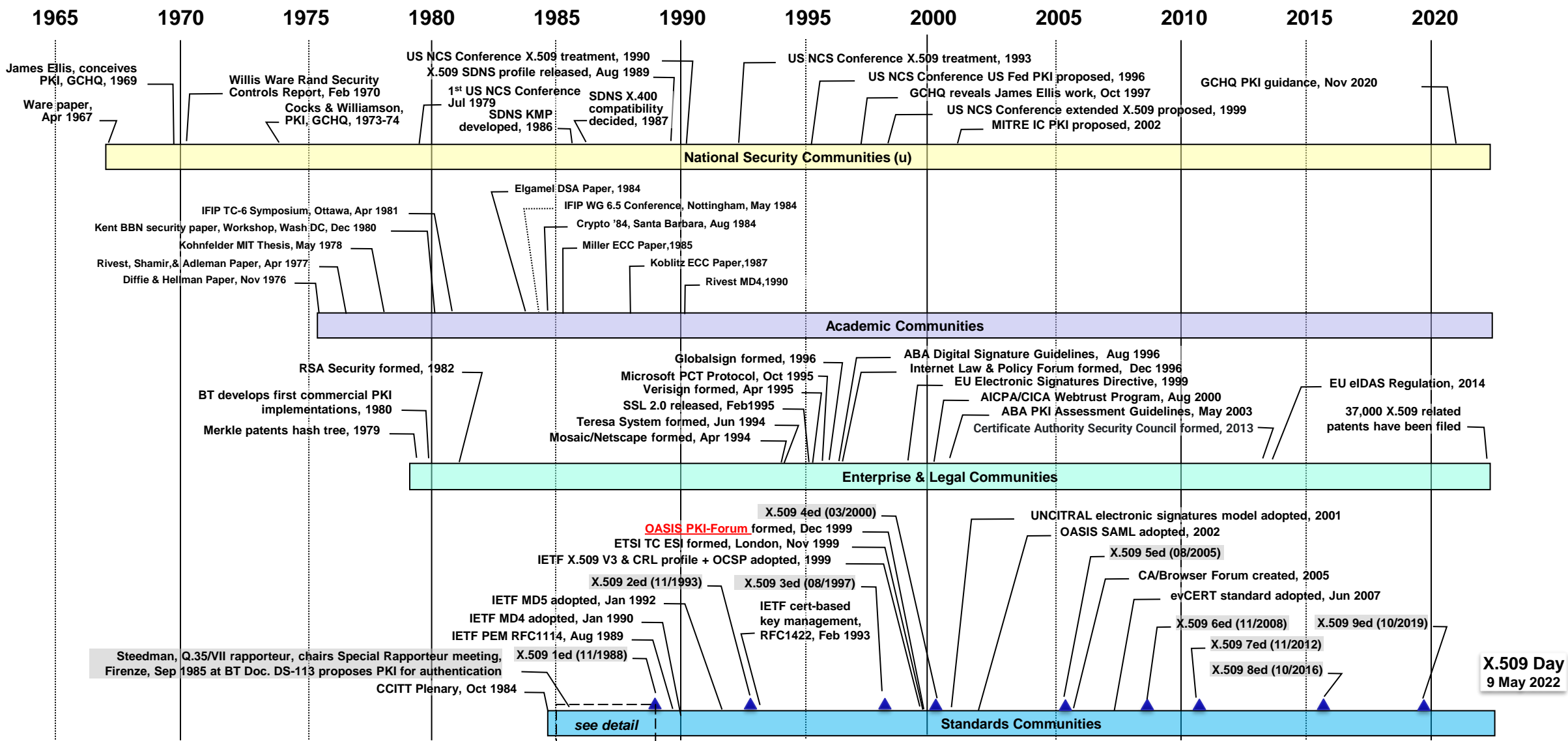


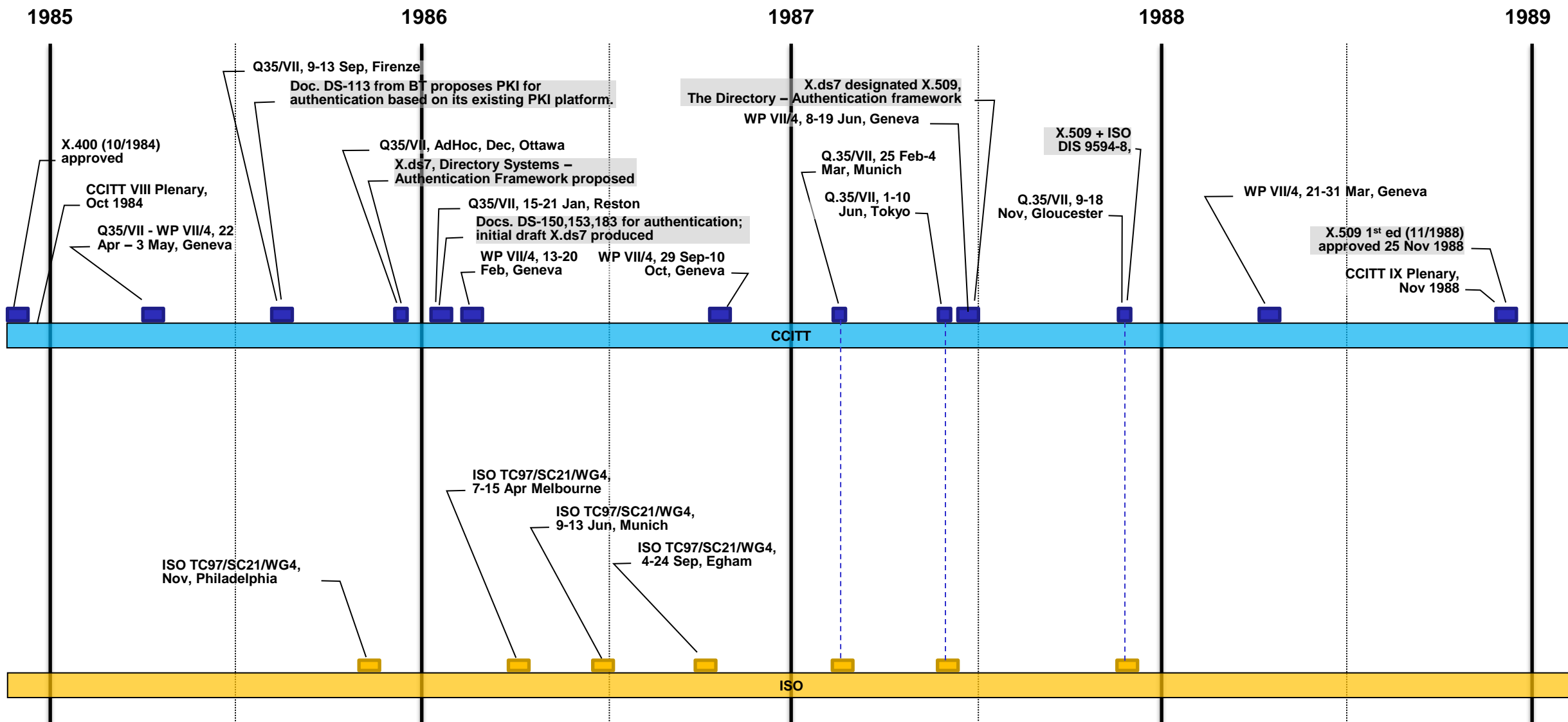
# Ecosystem long-arc timeline for the ITU encryption work



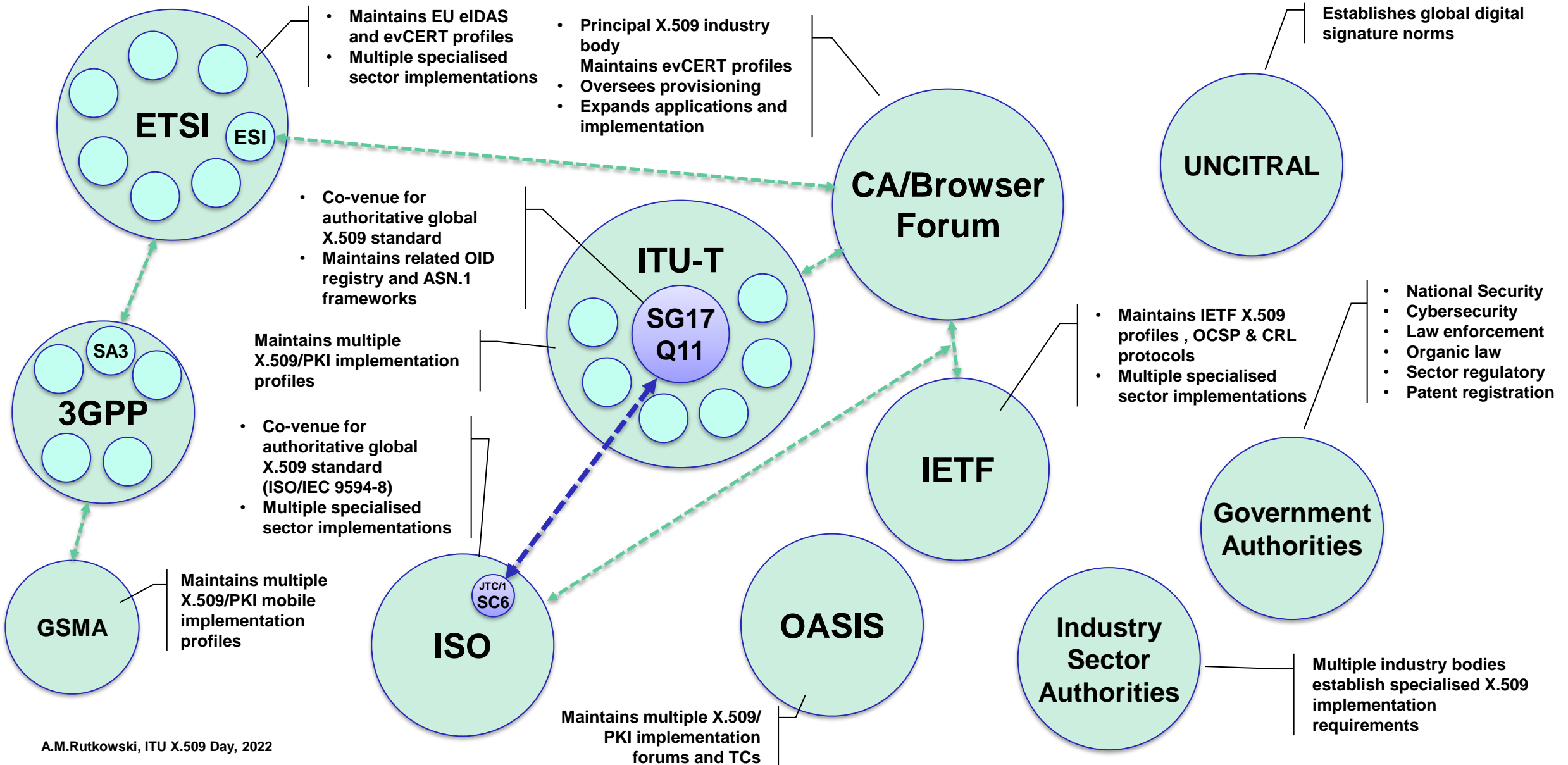
# Ecosystem timeline for Rec. ITU-T X.509



# Timeline of Rec. ITU-T X.ds7 (X.509) Standard 1985-1988



# X.509 Standards Ecosystem



# X.509 Ecosystem Use-case Evolution

- Classic use cases
  - Began as messaging authentication mechanism
  - + Endpoint trust mechanism
  - + Transport trust mechanism
  - + Proliferation of client-server platforms
- Authentication challenges\*
  - Universality (i.e., centralization) was not feasible
  - Authentication became costly and difficult
  - Objects/people emerged with multiple identities/ontologies
  - Individual privacy became increasingly important
- Emerging new use cases
  - Zero-Trust Architectures (ZTA)
  - Software Defined Perimeters (SDP)
  - Cloud Security
  - Internet of Things (IoT)
  - Secure Software Distribution
  - eForensics
  - Crypto Currency/ Digital Assets
  - Non-Fungible Tokens (NFTs)
  - Smart Contracts
  - Notarization
  - Anti-Money Laundering / Know Your Customer (AML/ KYC) for DeFi
  - Electronic Vehicles
  - Supply Chains
  - New forms of Corporate Structures (e.g., Decentralized Autonomous Organization (DAO))

\* See <https://nap.nationalacademies.org/read/10656>

# X.509 Editions

1. X.509 (11/1988) and ISO 9594-8, Information Processing Systems – Open Systems Interconnection – The Directory – Authentication Framework
2. X.509 (11/93) and ISO/IEC 9594-8:1995, Information Technology – Open Systems Interconnection – The Directory: Authentication Framework
3. X.509 (08/97) and ISO/IEC 9594-8:1998, Information Technology – Open Systems Interconnection – The Directory: Authentication Framework
4. X.509 (03/2000) and ISO/IEC 9594-8:2001, Information Technology – Open Systems Interconnection – The Directory: Public-key and attribute certificate frameworks
5. X.509 (08/2005) and ISO/IEC 9594-8:2005, Information Technology – Open Systems Interconnection – The Directory: Public-key and attribute certificate frameworks
6. X.509 (11/2008) and ISO/IEC 9594-8:2008, Information Technology – Open Systems Interconnection – The Directory: Public-key and attribute certificate frameworks
7. X.509 (10/2012) and ISO/IEC 9594-8:2014, Information Technology – Open Systems Interconnection – The Directory: Public-key and attribute certificate frameworks
8. X.509 (10/2016) and ISO/IEC 9594-8:2017, Information Technology – Open Systems Interconnection – The Directory: Public-key and attribute certificate frameworks
9. X.509 (10/2019) and ISO/IEC 9594-8:2020, Information Technology – Open Systems Interconnection – The Directory: Public-key and attribute certificate frameworks